

3. Animal Communities in the Southern North Sea.
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(Text-figure 1.)

Having determined the quantity and charted the distribution of the bottom animals in the Danish Seas ("Valuation of the Sea," I. and II.: Reports XX. and XXI., from the Danish Biological Station, 1911 and 1913), Dr. C. G. Joh. Petersen in 1914 published an appendix to Report XXI. (in Reports from the Danish Biological Station, XXII., 1914), in which he, on the basis of various statements in the literature, gave a hypothetical chart of the animal communities outside Denmark. In this the North Sea is charted as chiefly a "*Venus*"-community, with the "*Macoma baltica*" community in some places along the shore, and an area in the deeper parts of the North Sea, marked with a ?, in which several indications in the literature suggested the occurrence of a "*Brissopsis*"-community. In the month of July 1921 I was enabled to accompany the English Fishery Research vessel 'George Bligh' on a cruise across the North Sea from Lowestoft to Esbjerg, during which Dr. Petersen's bottom sampler, "the Petersen Grab," was used; by the courtesy of the Director of Fishery Investigations, Dr. E. S. Russell, I was given permission to work out and publish the material procured. Though the route followed did not touch the deeper parts of the North Sea, as will be seen from the accompanying chart of the stations (p. 30), and consequently cannot give information about the existence or not of the "*Brissopsis*" area mentioned above, still the 20 stations worked during this cruise can be of service in giving a preliminary orientation of the communities in the Southern North Sea.

In the accompanying Valuation List the stations have been arranged in communities. It will be seen that with some hesitation I have referred the first two stations to the "*Venus*"-community. These two stations contain, however, too few bottom animals to settle the question. Among the characteristic species of the "*Macoma baltica*" community, which, with the kind help of Captain Davis, I found in large quantities by digging along the shore-line at ebb-tide in the harbour of Lowestoft, viz., *Macoma baltica*, *Scrobicularia plana*, *Mya arenaria*, and *Cardium edule*, only one small *Mya arenaria* was found, at Station 2; whereas a representative of the "Epi-Fauna" of this community, viz. *Mytilus edulis*, is present in numbers at this station. On the other hand, a small *Ophioglypha albida* and two *Natica alderi* point

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to the "Venus"-community, if anything; so it is possible that the hard sand and gravel bottom here in the strong current off Lowestoft is a transition area between these two communities; at all events it is certainly a very poor area, exception made of the Epi-fauna (to this also must be reckoned *Strongylocentrotus drobachiensis*, the Hydroids, and *Sabellaria alveolata*, which last-named species is not found in Danish waters inside the Skaw).

Stations 3-11 and 16-19 are typical "Venus"-stations, with the characteristic species *Venus gallina*, *Tellina fabula*. *Macra*

Text-figure 1.

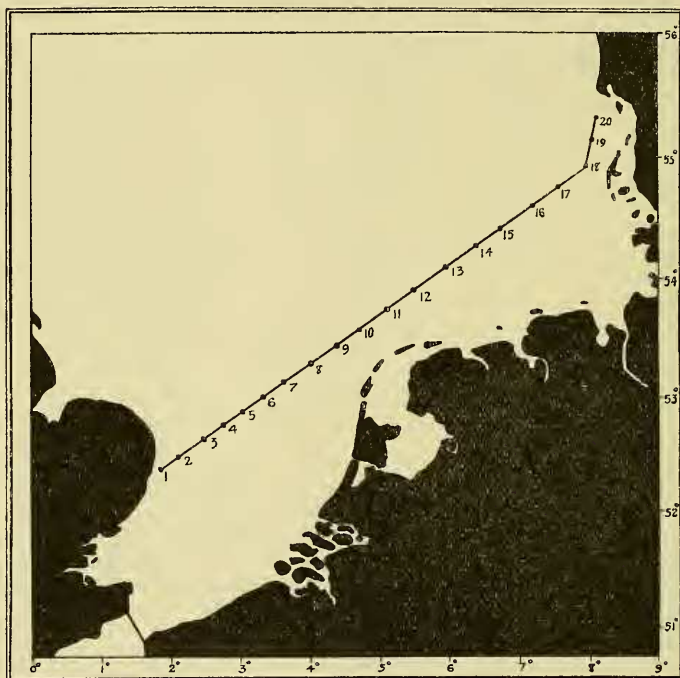


Chart showing Stations worked by the 'George Bligh,' 6th-8th July, 1921.

- Stations 1-2. *Venus* (?) Community.
 „ 3-11, 16-19. *Venus* Community.
 „ 12-15. *Echinocardium-filiformis* Community.
 Station 20. *Abra* Community.

subtruncata, *Donax vittatus*, and *Echinocardium cordatum*. Among the "attendant species," *i. e.* species frequently occurring in the community in question, but which may also be found in others,

I may particularise *Natica alderi*, *Ophelia limacina*, *Pectinaria koreni*, and *Echinocyamus pusillus*. In stations with no characteristic animals, I have attached importance to these species, which in conjunction with the depth, condition of bottom, and scarcity of animals, all point to the "Venus"-community. The occurrence of *Abra prismatica* and *Mactra elliptica* in some stations is indicative of the "deep Venus" community, which has been found in the deeper parts of the Danish "Venus"-community; but as the characteristic species *Echinocardium flavescens* and *Spatangus purpureus*, so typical of this community, are wanting, I can for the present only designate these stations as "Venus"-stations in general.

Stations 12-15 are characterised by such animals as *Amphiura filiformis*, *Turritella terebra*, *Axinus flexuosus*, and *Echinocardium cordatum*. Stations 12 and 13, however, are transitional from the "Venus"-community, containing several of the characteristic animals of this community but mostly as small specimens, and only a few *Amphiura*. But as a whole these stations must be reckoned as belonging to the "*Echinocardium-filiformis*" community. The bottom, consisting previously of hard sand or gravel, is here softer, mixed with detritus and clay. This community is not represented in Dr. Petersen's hypothetical chart in Rept. XXII. (on this point see remarks in Rept. XXIII., 1915, p. 10, at the top); it was charted in Rept. XXI. as the "*Echinocardium-Turritella*" community, which is widely distributed in the Kattegat, Skagerrak, and Christiania Fjord. Without doubt it will later become apparent that this community covers big areas in the deeper parts of the North Sea.

The last station, No. 20, in the neighbourhood of Graa-deep light-vessel, is a typical "*Abra*"-station, with *Abra alba*, *Nucula nitida*, and fragments of *Echinocardium cordatum*. The existence here of an "*Abra*"-community was already proved in 1912 by some few samples taken by the 'Michael Sars' in the neighbourhood of Graa-deep and Horns Reef.

We have thus met with four different communities:—a "*Macoma baltica*"-community along the shore in Lowestoft Harbour; a "Venus"-community in the greater part of the investigated area of the North Sea, with depths most frequently between 9 and 38 m. and a pure sand and gravel bottom; an *Echinocardium filiformis* community in depths of 38-41 m. with a dark, soft sandy bottom; and finally, an *Abra*-community near the shores of Jutland. Possibly this last-named community also will be discovered near Lowestoft, as in a single sample taken with the grab in Lowestoft Harbour, in a depth of 3 m. at ebb tide, I found one adult *Abra alba*. But it is beyond doubt that the greater part of the bottom fauna of the North Sea below 38 m. will turn out to belong to "Venus"-community, as indicated in Dr. Petersen's chart. This is confirmed also by the few samples taken in former years with the bottom sampler off Thyboron (Report XXI., Appendix pp. 63-66), and by the numerous samples which

according to the friendly communication of Dr. Russell, have been taken with the bottom sampler this year on the Dogger Bank.

As to the number of animals per square mile, it will be seen from the accompanying list (pp. 28-29) that, setting aside the Epi-Fauna, we have to do with a comparatively poor fauna. For instance, the "Venus"-stations together give only 26.3 gr. per 2.6 sq. m. or 10.1 gr. per sq. m. But on the other hand, most of the animals are useful as being excellent fish-food. Compared with the "Venus"-community in the Kattegat (Rept. XXI., Appendix, pp. 9-13), it will be seen that the apparent richness of the latter is due mainly to big echinoderms such as *Echinocardium* and Ophiurids, or big lamellibranchs such as *Cyprina* or *Macoma calcarea*, useless as fish-food.

On the other hand, we may find in the North Sea as well as in the Kattegat small areas within the "Venus"-community, inhabited by large numbers of *Macra subtruncata* (see, for instance, St. 8 in Rept. XXI., Appendix, p. 65, with over 2 kg. per sq. m., also among the samples taken by the 'George Bligh' this year on the Dogger Bank, several of which contain some hundreds of specimens per 0.2 sq. m.). It would be of the greatest interest to know something further about the distribution and abundance of this most important food species, at different times of the year and at different places in the North Sea. At the same time continued investigation of the stomach-content of the food-fishes is called for, following up the excellent work of Todd (Second Report on the Food of Fishes, North Sea Investigation Committee, Southern Area, Second Report, Part I., 1904-5). From his paper it would appear that the food of the fish in the south-western North Sea is composed mainly of "Venus"-animals. But, as mentioned above, we have in the deeper central parts of the North Sea an extended area, which is still a *terra incognita* and still awaits charting.